भारतीय मानक
Indian Standard

IS 4308 : 2019

(Amalgamating IS 4861 : 1984
and IS 14609 : 1999)

अग्निशमन के लिए शुष्क रासायनिक पाउडर — बीसी, एबीसी और डी टाइप — विशिष्टि

(तीसरा पुनरीक्षण)

Dry Chemical Powders for Fire Fighting — BC, ABC and D Types — Specification

(Third Revision)

ICS 13.220.10

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FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Fire Fighting Sectional Committee had been approved by the Civil Engineering Division Council.

This Indian Standard was first published in 1962 and subsequently revised in 1982 and 2003. In this revision, the Indian Standard specifications pertaining to ABC and D type powders have been included which were previously covered separately in IS 14609 : 1999 'Dry chemical powder for fighting A, B, C class fires — Specification' and IS 4861 : 1984 'Specification for dry powder for fighting fires in burning metals', respectively. IS 14609 and IS 4861 shall stand withdrawn subsequently.

Based on inputs from technical committee members, manufacturers, users and testing laboratories some requirement of chemical contents of sodium or potassium bicarbonate in BC powder have been changed to minimum 75 percent from 90 percent. About 90 to 95 percent of application of powder is through fire extinguishers. Hence, the fire performance test using extinguisher as per IS 15683 : 2006 'Portable fire extinguishers — Performance and construction — Specification' has been included in the revision. New formulation developed nationally and internationally with its test method has been included in this revision.

Caking, lumping, hardness and heat resistance tests have been deleted in this revision as tests such as hygroscopicity, moisture content, fluidity and water repellency takes care of them. Moreover, for the environmental effects of the chemicals used in the powders, manufacturers have been asked to declare the name and percentage of the main chemical constituent and any other chemicals used, only if more than 10 percent.

The efficiency of dry chemical powder for extinguishments is governed by its physical properties and chemical composition. Particle size of the powder is an important characteristic which determines its fire knock down properties and keeping qualities when used in extinguishers. As very fine particle are carried away with flame draft, fine particles have better fire knock down properties but cannot be easily projected out, the coarse particles are also allowed to achieve better ballistic properties. Therefore fine and coarse powder particle must be balanced while manufacturing this powder, generally composed of basically carbonates and bi-carbonates of alkali metals such as sodium and potassium (Class BC), monoammonium phosphate (Class ABC), Eutectic mixture of chlorides of sodium, potassium and barium (Class D) with additives to make it water repellent, free flowing and conforming to various requirements of this standard. While selecting the various raw materials for the manufacture of these dry chemical powders shall be non-toxic, non-corrosive, non-abrasive and electrically non-conductive.

In the following situations, the use of dry chemical powder covered in this standard shall not be considered satisfactory:

a) Fires involving chemicals containing their own oxygen supply such as cellulose nitrate, etc; and
b) Area where residual deposits of the powder may adversely affect electronic equipments or delicate electrical relays.

The composition of the Committee responsible for formulation of the standard is given in Annex M.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of specified value in this standard.

Indian Standard

DRY CHEMICAL POWDERS FOR FIRE FIGHTING — BC, ABC AND D TYPES — SPECIFICATION

(Third Revision)

1 SCOPE

This standard lays down the chemical and physical requirements of dry chemical powder for use as extinguishing medium for fighting Class A, Class B, Class C and Class D fires.

2 REFERENCES

The standards listed below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards given below:

IS No.	*Title*
4905 : 2015/ ISO 24153 : 2009	Random sampling and randomization procedures (*first revision*)
7673 : 2004	Glossary of terms for fire fighting equipment (*first revision*)
15683 : 2018	Portable fire extinguishers — Performance and construction — Specification (*first revision*)

3 TERMINOLOGY

For the purpose of this standard, definition given in IS 7673, and the following shall apply.

3.1 Class A — Fires involving solid combustible materials of organic nature such as wood, paper, rubber, plastic, etc, where the cooling and coating effect is essential to extinguish the fire.

3.2 Class B — Fires involving flammable liquids or liquefiable solid, gases or the like where a blanketing effect is essential to extinguish the fire.

3.3 Class C — Fires involving flammable gases under pressure including liquefied gases, where it is necessary to inhibit the burning gas at fast rate powder or vapourizing liquid for extinguishment.

3.4 Class D — Fires involving combustible metal such as magnesium, aluminum, zinc, sodium, potassium and radioactive metals, etc, when the burning metals are reactive to water containing agents and in certain cases carbon dioxide, halogenated hydrocarbons and BC and ABC dry powders are not suitable. Class D fire requires special media and technique to extinguish.

3.5 Batch — For the purpose of acceptance and verification testing by an inspecting authority, a batch of powder is single charge material in the manufacturing process and under the same environmental conditions.

4 CLASSIFICATION

The dry chemical powder used for fire extinguishing shall be classified in to the following categories:

a) BC type,
b) ABC type, and
c) D type.

5 REQUIREMENTS

Dry chemical powder shall comply with the requirements given in Table 1.

6 GENERAL INFORMATION

a) Dry chemical powder must be safe for use on live electrical equipment, and must not contain any electrically conductive material.
b) Various materials and additives used to produce extinguishing powders should be non-toxic to humans.
c) Discharge of large amounts of dry chemical powder may create hazards to personnel in the vicinity such as reduced visibility and temporary breathing difficulty.
d) Ammonium phosphate and eutectic chloride are slightly acidic, and in the presence of moisture, they can corrode metals such as steel, cast iron and aluminium.
e) Potassium bicarbonate, sodium bicarbonate and urea based potassium bicarbonate are slightly basic and in the presence of moisture they can corrode metal such as aluminium, bronze and titanium. However, prompt clean up, if done, can avoid such corrosion, ammonium phosphate based agent will require some scraping and cleaning if exposed surfaces were hot when the agent was applied.

Table 1 Requirements for Dry Chemical Powder

(*Clause* 5)

Sl No.	Characteristic	Requirement			Method of Test, Ref to Annex
		BC Type	ABC Type	D Type	
(1)	(2)	(3)	(4)	(5)	(6)
i)	Main chemical constituent	Sodium/Potassium bicarbonate	Monoammonuim phosphate	Eutectic mixture of chlorides of sodium, potassium and barium	A
ii)	Minimum main chemical constituent	75 Percent	40 Percent	90 Percent (Determined by melting point method)	
iii)	Apparent density	Declared value by the manufacturer ± 10 Percent	Declared value by the manufacturer ± 10 Percent	Declared value by the manufacturer ± 10 Percent	B
iv)	Particle size / sieve analysis	Declared value by the manufacturer	Declared value by the manufacturer	Declared value by the manufacturer	C
v)	Hygroscopicity	2.0 Percent (*Max*)	2.0 Percent (*Max*)	2.0 Percent (*Max*)	D
vi)	Water repellency	1.5 Percent (*Max*)	1.5 Percent (*Max*)	1.5 Percent (*Max*)	E
vii)	Moisture content	0.5 Percent (*Max*)	0.5 Percent (*Max*)	0.5 Percent (*Max*)	F
viii)	Rate of flow	50 g/s (*Min*)	50 g/s (*Min*)	30 g /s (*Min*)	G
ix)	Foam compatibility (required if declared by the manufacturer)	Min. 50 Percent burn back of original	*Min*. 50 percent burn back of original	Not applicable	H
x)	Fire test	Fire shall be extinguished	Fire shall be extinguished	Fire shall be extinguished	J
xi)	Temperature resistance test	Maximum retention 20 Percent	*Max*. retention 20 Percent	*Max*. retention 20 Percent	K
xii)	Colour	White	Pale yellow	Grey	Visual examination

f) Dry chemical powder shall not be considered satisfactory for use on machinery such as carding equipment in textile operations and delicate electrical equipment, because upon exposure to temperature in excess of 121°C, or relative humidity in excess of 50 percent deposits will be formed which may be corrosive, conductive of electricity and difficult to remove.

7 SAMPLING AND CRITERIA FOR CONFORMITY

7.1 Scale of Sampling

7.1.1 *Lot*

All the containers in a single consignment of the material of the same type drawn from a single batch of manufacture shall constitute a lot.

7.1.2 The sample shall be tested from each lot for ascertaining the conformity of the material to the requirements of the standard. The number of containers to be selected from each lot shall depend upon the size of the lot and shall be in accordance with col 2 and col 3 of Table 2. Again 2 kg of powder shall be taken is equal proportion from each selected container and mixed together to make a composite sample. All tests shall be carried out from one composite sample.

Table 2 Scale of Sampling

(*Clause* 7.1.2)

Sl No.	Lot Size	Sample Size
(1)	(2)	(3)
i)	Up to 50	3
ii)	51 to 100	4
iii)	101 to 150	5
iv)	151 to 300	6
v)	301 and above	7

7.2 These containers shall be selected from the lot at random. In order to ensure the randomness of selection, procedures given in IS 4905 may be followed.

8 PACKING

8.1 The powder shall be packed in hermetically sealed moisture proof bags or containers lined with plastic in the quantities as per the requirement of the purchaser.

8.1.1 The strength of the container used shall be such that no distortion or failure of the container shall occur when it is kept on a flat surface on any of its side's ends and a weight of 10 kg is applied to it. The container shall not crack or rupture to any extent when dropped from a height of 1 m on a concrete surface after being packed.

8.2 The hermetically sealed moisture proof bags or containers filled with powder of suitable size shall be immersed in potable water for 5 h. After 5 h the powder taken out from the bag/container to be tested for its moisture content and fluidity test and shall meet the requirements given in Table 1.

9 MARKING

9.1 Each bag/container of dry chemical powder shall be legibly and indelibly marked with the following information:

a) Manufacturer's name or trade-mark;
b) Type of powder — BC type or ABC type or D type;
c) Quantity of the powder, in kg;
d) Date of manufacture/Batch No.;
e) Chemical name and percentage of main chemical constituent and other chemicals used (only if more than 10 percent); and
f) Foam compatibility (optional).

9.2 BIS Certification Marking

The dry chemical powder may also be marked with the Standard Mark.

9.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations made thereunder. The details of the conditions under which the licence for use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(*Table* 1)

METHOD FOR DETERMINATION OF CHEMICAL CONTENT

A-1 The declared chemical content of the extinguishing powder need not include constituents making up less than 10 percent by mass of the extinguishing powder. However the chemical content declared shall cover more than the values given in Table 1 of the total composition of the extinguishing powder. If the declared value is more than the minimum requirement then the compliance shall be made to the declared value with the tolerance not exceeding -5 percent of the declared value. Any standard method (published) may be adopted by the manufacturer for the determination of chemical content. One such standard method for the determination of such chemical content of the dry chemical powder are given in **A-2** to **A-4** as reference.

A-2 DETERMINATION OF SODIUM/ POTASSIUM BICARBONATE IN DRY CHEMICAL POWDER

A-2.1 General

This method is intended to determine the content of sodium bicarbonate or potassium bicarbonate in BC type dry chemical powder which may contain water proofing and fluidizing agent and other materials required for satisfactory performance. This method assumes that all bicarbonate is present as the sodium salt or the potassium salt, as applicable.

A-2.2 Apparatus

The following apparatus shall be used:

a) *Analytical balance*, capable of weighing accurately to 0.1 mg.

b) *Aluminium dishes*, 65 mm dia × 44.5 mm high.

c) *Glass desiccators*, containing 95 percent to 98 percent by mass reagent grade sulphuric acid as drying agent or calcium carbonate ($CaCO_3$)/ silica gel, another containing molecular sieves or anhydrous calcium chloride ($CaCl_2$) as drying agent.

d) *Oven*, capable of operating in the range of 250°C.

e) Sodium bicarbonate or potassium bicarbonate reagent grade/lab grade.

A-2.3 Procedure

a) Heat a clean, capped aluminium dish in an oven at 250°C for 30 min, transfer quickly to a desiccator containing anhydrous calcium chloride or molecular sieves. Allow it to cool to room temperature. Then weigh the capped dish quickly to 0.1 mg accurately. This is the tare mass of the dish.

b) Transfer about 2.5 to 3 g powder of sample into the aluminium dish, and place the dish in a desiccator over sulphuric acid for 30 min to dry to constant mass and weigh again.

c) Heat the uncapped dish with the dry sample in an oven at 250 °C for at least 16 h and then transfer to a desiccator containing drying agent. After cooling to room temperature, the dish must be weighed to an accuracy of ± 0.1 mg as quickly as possible.

d) Sampling, drying, heating and cooling conditions, and weighing technique shall be verified as necessary using reagent grade sodium bicarbonate or potassium bicarbonate in place of the dry chemical fire extinguishing agent sample. A value of over 99.0 percent sodium bicarbonate ($NaHCO_3$) for reagent grade sodium bicarbonate or over 99.0 percent potassium bicarbonate ($KHCO_3$) for reagent grade potassium bicarbonate shall constitute verification of the test procedure.

A-2.4 Calculation

Calculate the percentage of sodium bicarbonate or potassium bicarbonate in the dry sample as:

$NaHCO_3$, percent = $(A/B) \times 270.9$

$KHCO_3$, percent = $(A/B) \times 322.8$

where

A = loss of mass after heating the sample at 250°C, in g; and

B = dry sample mass, in g.

A-3 DETERMINATION OF MONO-AMMONIUM PHOSPHATE IN DRY CHEMICAL POWDER

A-3.1 General

The method is intended to determine the mono-ammonium phosphate content of ABC type dry chemical powder which may contain waterproofing and fluidizing agents and other materials required for satisfactory performance. It is not applicable to products containing other alkali phosphates or water alcohol soluble compounds which react with aqueous sodium hydroxide.

A-3.2 Apparatus

The following apparatus shall be used:

a) *Analytical balance*, capable of weighing accurately to 0.1 mg.

b) *Centrifuge tubes*, 100 ml capacity preferably cone-shaped.

c) Centrifuge machine.

d) *Steam bath*, capable of maintaining approximately 95°C.

e) *p*H meter.

f) *Burette*, 50 ml capacity, graduated in 0.1 ml divisions.

g) *Oven*, capable of operating in the range of 60°C.

h) Reagent grade/lab grade chemicals shall be used, unless otherwise indicated. Other grades may be used provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without decreasing the accuracy of the determination.

1) Absolute or denatured ethanol (a reagent blank is required if denatured alcohol is used).

2) *50 percent ethanol* — Mix 1 volume of absolute ethanol (or appropriate volume of denatured ethanol) with 1 volume of water.

3) *Sodium hydroxide (1.0 mol/l)* — Dissolve 40 to 45 g of sodium hydroxide (NaOH) in one litre of water. Standardize potentiometrically against primary standard potassium hydrogen phthalate.

A-3.3 Procedure

a) Weigh to the nearest 0.1 mg approximately 3 g of sample in 100 ml centrifuge tube. Add 50 ml of 50 percent ethanol and mix well. Support the centrifuge tube in a steam bath setting at approximately 95°C for about 5 min with frequent period of vigorous shaking with taking care so that no liquid comes out.

b) Place the warm solution in centrifuge machine and centrifuge at, approximately 1 500 rpm for 5 min. After completion of 5 min decant the centrifuge into a 250 ml beaker. Repeat the extraction thrice transferring the extracts to the original 250 ml beaker.

c) Evaporate the extracts to dryness on a steam bath.

d) Dissolve the dried residue in approximately 75 ml water and titrate potentiometrically with the standardized sodium hydroxide (NaOH) solution using a *p*H meter previously standardized at *p*H 7.0. Firstly check the *p*H of the solution without adding sodium hydroxide (NaOH) and then add the sodium hydroxide (NaOH) in increment of about 1.1 ml and determine the *p*H and continue the process until the equivalence point of *p*H 8.05 is obtained. Plot *p*H readings versus ml of sodium hydroxide (NaOH) added and determine the equivalence point from titration curve (*p*H 8.05 ± 0.02).

A-3.4 Calculation

Calculate the mono-ammonium phosphate content, percent by mass, as follows:

$$NH_4H_2PO_4,\ \text{percent} = \frac{A \times B}{W} \times 11.50$$

where

A = volume of NaOH used (corrected for any blank), in ml;

B = concentration of NaOH, in mol/l; and

W = mass of sample as received, in g.

A-4 DETERMINATION OF EUTECTIC CHLORIDE MIXTURE BASED ON SALTS OF SODIUM, POTASSIUM AND BARIUM IN DRY CHEMICAL POWDER

The content of eutectic chloride mixture based on salts of sodium, potassium and barium in D type dry chemical powder shall be derived from the melting point of the powder. Any standard test method for determination of melting point may be used. The melting point of the powder shall be 540°C ± 10°C.

ANNEX B

(*Table* 1)

METHOD FOR DETERMINATION OF APPARENT DENSITY

B-1 A sample of 100 ± 1 g of the dry powder shall be placed in a clean, dry 250 ml, stoppered glass graduated measuring cylinder having an approximate height of 320 mm and approximate internal diameter of 40 mm. Secure the stopper in cylinder. Rotate the cylinder vertically end to end that is, up and down for ten complete revolutions, slowly at a rate of approximately 1 revolution every 2 s. Immediately after the ten revolutions have been completed, set the cylinder upright on a level surface and allow the powder to settle for 180 s. Read off the volume occupied by the powder and calculate the apparent density from the following equation:

$$\text{Apparent density} = \frac{100}{\text{volume of powder, in ml}}$$

ANNEXC

(*Table* 1)

METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION

C-1 Place the 6″/8″ dia sieve of 100 mesh, 200 mesh and 325 mesh sieve and bottom pan in ascending order with top cover on the sieve shaker of electric operated type. Weigh approximately 100 g of powder in to the top sieve that is, in the 100 mesh sieve placed at the centre of the top sieve and tight all the sieves with the tightening device nut. Shake for 20 min. Weigh accurately the quantity of powder retained on each sieve and report as percentage retained on each sieve. It is recommended to use sieve balls or cubes on every sieve during testing.

ANNEX D

(*Table* 1)

METHOD FOR DETERMINATION OF HYGROSCOPICITY

D-1 Weigh accurately 25 g of dry chemical powder in a 250 ml beaker. Keep the beaker in at 85 ± 5 percent relative humidity chamber maintaining temperature 27 °C ± 5 °C and take the weight of the beaker after 48 h of conditioning in humid chamber. Increase in weight shall be noted and percentage hygroscopicity shall be calculated as follows:

$$\text{Hygroscopicity, Percent} = \frac{\text{Increase in weight of sample}}{\text{Original weight of sample}} \times 100$$

ANNEX E

(*Table* 1)

METHOD FOR DETERMINATION OF WATER REPELLENCY TEST

E-1 Dry powder weighing 50 g shall be placed in a clean dry 100 ml weighed beaker and gradually filled with 50 ml of distilled water having temp 27 ± 5°C. After 2 min, the dry powder and the water from the beaker shall be gently poured out and weigh the beaker with wet powder, if any sticking to the beaker, dried in an oven at 60°C for 2 h and then cool in a desiccator containing anhydrous calcium chloride for 1 h. The beaker shall then be weighed and the weight of dry residue calculated. The increase in the weight of the beaker due to powder residue sticking to the beaker shall not exceed 0.75 g that is 1.5 percent.

ANNEX F

(*Table* 1)

METHOD FOR DETERMINATION OF MOISTURE CONTENT

F-1 Weigh accurately a sample of approximately 50 g into a tared petri dish having approximately 70 mm diameter and 10 mm depth. Place the dish holding powder sample in a desiccator using 95 to 98 percent by mass reagent grade sulphuric acid as a drying agent. Maintain the closed desiccator contents at a temperature of 27 ± 5°C for 24 h. At the end of this period, remove the test sample and weigh accurately. Calculate the moisture content of the sample from the following equation:

$$M = \frac{W_1 - W_2}{W_1 - W} \times 100$$

where

M = moisture content, in percent;

W = mass of empty, clean and dry aluminium dish;

W_1 = mass of aluminium dish holding powder before drying; and

W_2 = mass of dish holding powder after drying the powder.

ANNEX G

(*Table* 1)

METHOD FOR DETERMINATION OF FREE FLOWING CHARACTERISTICS (EFFICIENT FLUIDITY)

G-1 GENERAL

A dry chemical powder having howsoever good fire inhibitory property when used in extinguishers may be rendered ineffective as it may not flow in pipes satisfactorily.

Dry chemical powder are generally filled in extinguisher bodies whether portable or wheeled units or in fixed installations or in special dry chemical powder tenders. Moisture free compressed gases like nitrogen, carbon dioxide or air are used to drive out the powder. In doing so the powder is required to flow through pipes, bends, rubber flexible hoses, etc. If the powder has less mobility it cannot be driven out satisfactorily hence cannot be projected on fire.

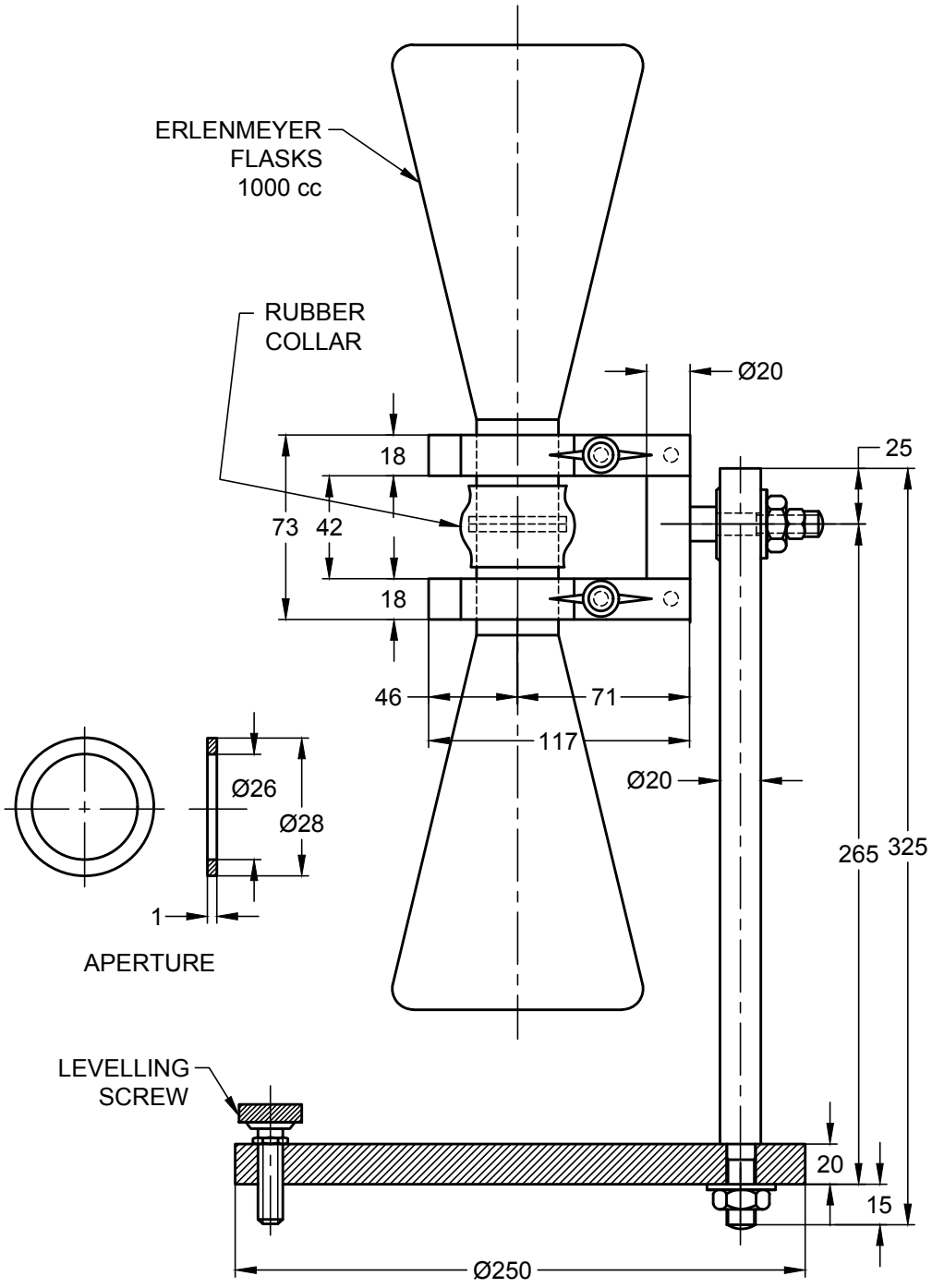
G-2 EQUIPMENT

The device consists of two numbers of Erlenmeyer glass conical flasks each of 1 000 ml capacity. One flask is inverted over the other such that they meet mouth to mouth. A clean, dry flask holding a known mass of powder 500 g under test is kept horizontally. A rubber collar tube is put on its neck. A disc made out of 1 mm thick stainless steel sheet and having a concentric aperture of 26 mm diameter is fixed horizontally into the neck. A similar clean, dry Erlenmeyer flask is inverted over the horizontal one and the free end of the rubber made collar tube is slipped over so that it covers the neck. The purpose of rubber tube made collar is to hold the two flasks mouth to mouth meeting. A suitable apparatus is shown in Fig. 1.

G-3 PROCEDURE

This assembly is held vertically by their necks in a suitable stand. The assembly of the two flasks is then turned rotated by 180° and kept held in this position, till all the powder mover/flows down to the lower flask. In this process some aeration of the powder sample takes place. As soon as the entire quantity of powder falls into the lower flask, the assembly is immediately again turned 180° and held in this position. In this way the process of aeration is continued and repeated so that in all aeration is done only ten times. Note that this aeration is to be done in quick succession without stopping in between consecutive aeration.

Immediately after the tenth run is over the measurement of fluidity is commenced by recording the period in s required for the powder to flow through completely. In quick succession total ten measurements are carried out. The arithmetic mean time '*t*' of these timings is calculated. Then the rate of flow that is, fluidity of powder is calculated by dividing the quantity 500 g by mean time, '*t*' second.



All dimensions in millimetres.

FIG. 1 ARRANGEMENT OF EQUIPMENT FOR FREE FLOWING

ANNEX H

(*Table* 1)

METHOD FOR DETERMINATION OF FOAM COMPATIBILITY

H-1 GENERAL

The following small-scale fire test can be used to show whether incompatibility between extinguishing powders and foams may exist.

This test is carried out on the foam in question, and then repeated after the fuel has been covered in powder. If the increase in extinction time is equal to or greater than 50 percent longer than the result without powder, then the combination of powder and foam may be considered to lead to an unacceptable loss in efficiency.

Likewise, a reduction in burn back time by 50 percent or more when powder is used would indicate that the foam and powder are incompatible. 500 ± 1 g powder is weighed into a 180 µm sieve, placed on a sheet of paper or cardboard. The sieve is held over the fuel, and the cardboard or paper removed. The powder is then evenly distributed over the surface of the fuel from a height of 150 ± 10 mm. The fuel is lit not more than 60 s after the powder has been spread over the surface of the fuel.

H-2 APPARATUS

H-2.1 Circular Fire Tray of Brass/Steel

The apparatus is shown in Fig. 2 with dimensions are as follows:

a) Internal diameter at rim : 565 ± 5 mm;
b) Height of vertical wall : 150 ± 5 mm;
c) Height of conical base : 30 ± 5 mm; and
d) Thickness of vertical wall : 1.2 ± 0.2 mm

It has a turned over rim, and a drain point with valve at the centre of the conical base.

NOTE — The tray has an area of approximately 0.25 m^2. The fire tray is supported approximately 1 m above the ground on a steel frame with four legs. The tray is normally placed beneath a suitable fume extraction hood which will extract the smoke without interfering with the fire.

H-2.2 Burn-back Pot of Brass/Steel

The apparatus has dimensions as follows:

a) Internal diameter at rim : 120 ± 2 mm;
b) Internal depth : 80 ± 2 mm; and
c) Thickness of wall : 1.2 ± 0.2 mm, with a turned over rim, and fitted with four studs at the base to give an overall height of 96 ± 2 mm. A chain fitted to the rim allows the burn-back pot to be lifted using a metal rod.

H-2.3 Foam-making Nozzle

The nozzle, shown in Fig. 3, has a nominal flow rate of 5 litre/min at 7 bar when tested with water. It is fitted with an adjustable collar to allow foam to be ejected from the side of the nozzle and thus vary the foam flow rate through the outlet. The foam flow rate can also be controlled by adjusting the pressure applied to the foam solution.

H-2.4 Fuel

Fuel shall be *n*-heptane and its certain mixture called commercial heptane with the following specification shall be used:

a) Distillation range : 84°C to 105°C;
b) Maximum difference between initial and final boiling point shall not exceed 10°C; and
c) Density/specific gravity : 0.65 to 0.75 at 27 ± 5°C.

H-3 TEST PROCEDURE

H-3.1 Test Conditions

Carry out the test under ambient temperature of 27 ± 5°C.

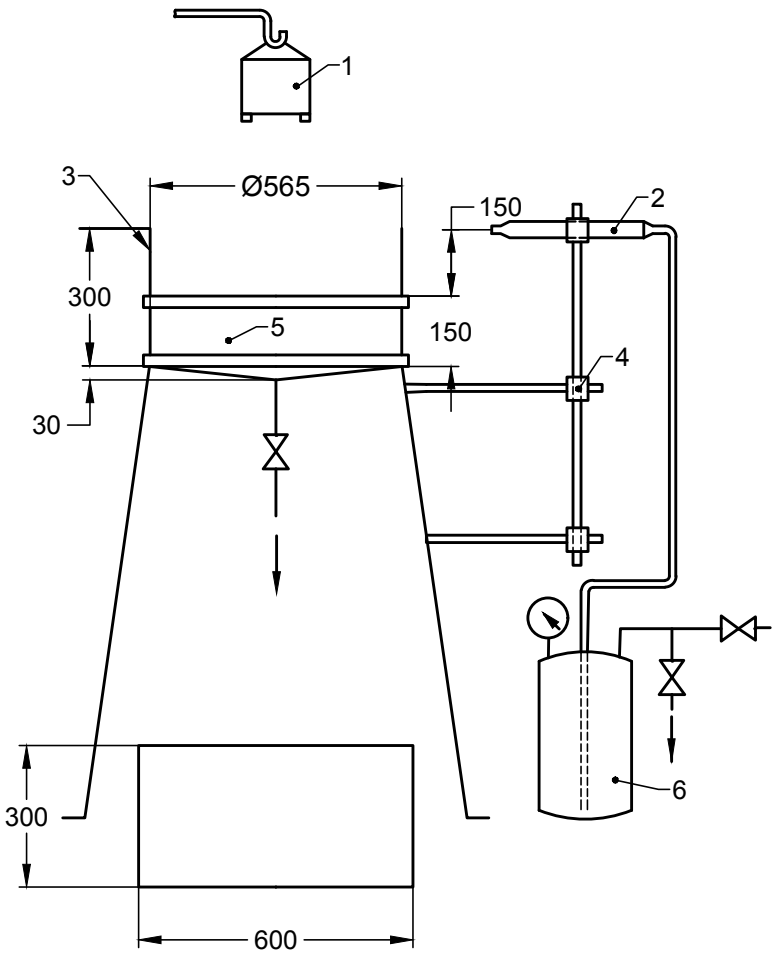
H-3.2 Set Up

Position the foam nozzle horizontally with the by-pass holes in the adjustable collar facing downwards at a height of 150 ± 5 mm above the rim of the fire tray (*see* Fig. 2). Prepare the foam solution following the recommendations of the supplier for concentration, maximum premix time, compatibility with test equipment, avoiding contamination by other types of foam, etc. Set the nozzle pressure to 7 bar and the foam flow rate to 0.75 ± 0.025 kg/min by adjusting the collar and, if necessary, reducing the nozzle pressure. It is convenient to collect the foam in a tarred vessel for 6 s and to weigh it to calculate the flow rate. Position the nozzle while keeping it horizontal so that the foam strikes the centre of the fire tray. Shut off the foam discharge. Clean the tray and close the drain valve.

H-3.3 Fire Test

Place 9 ± 0.1 litre of fuel in the tray, and 0.3 ± 0.01 litre of fuel in the burn-back pot. 120 ± 2 s after fuelling ignite the fuel and allow to burn for 60 ± 2 s before starting foam application. Apply foam for 120 ± 2 s to the centre of the tray and record the time from the start of foam application to complete extinction.

At the end of foam application ignite the fuel in the burn-back pot, and 60 ± 2 s after the end of foam application, lower the pot into the centre of the tray with a metal rod, taking care not to allow foam to enter the pot. Record the time taken from positioning of the burn-back pot to permanent full re-involvement of the fire tray surface in flames as the burn-back time.

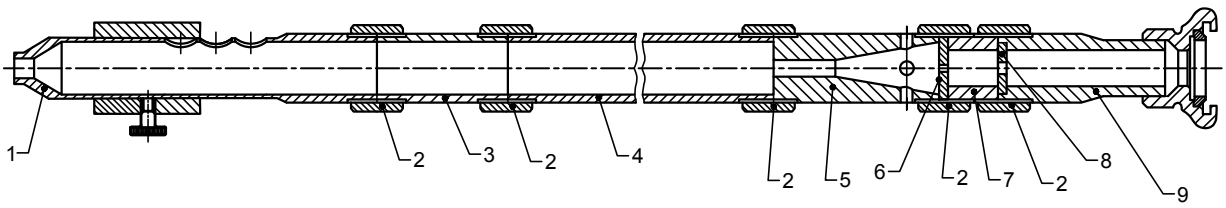


KEY

1	BURN-BACK POT	4	ADJUSTABLE BOSS
2	FOAM NOZZLE	5	FIRE TRAY
3	BACKBOARD (OPTIONAL)	6	FOAM SOLUTION

All dimensions in millimetres.

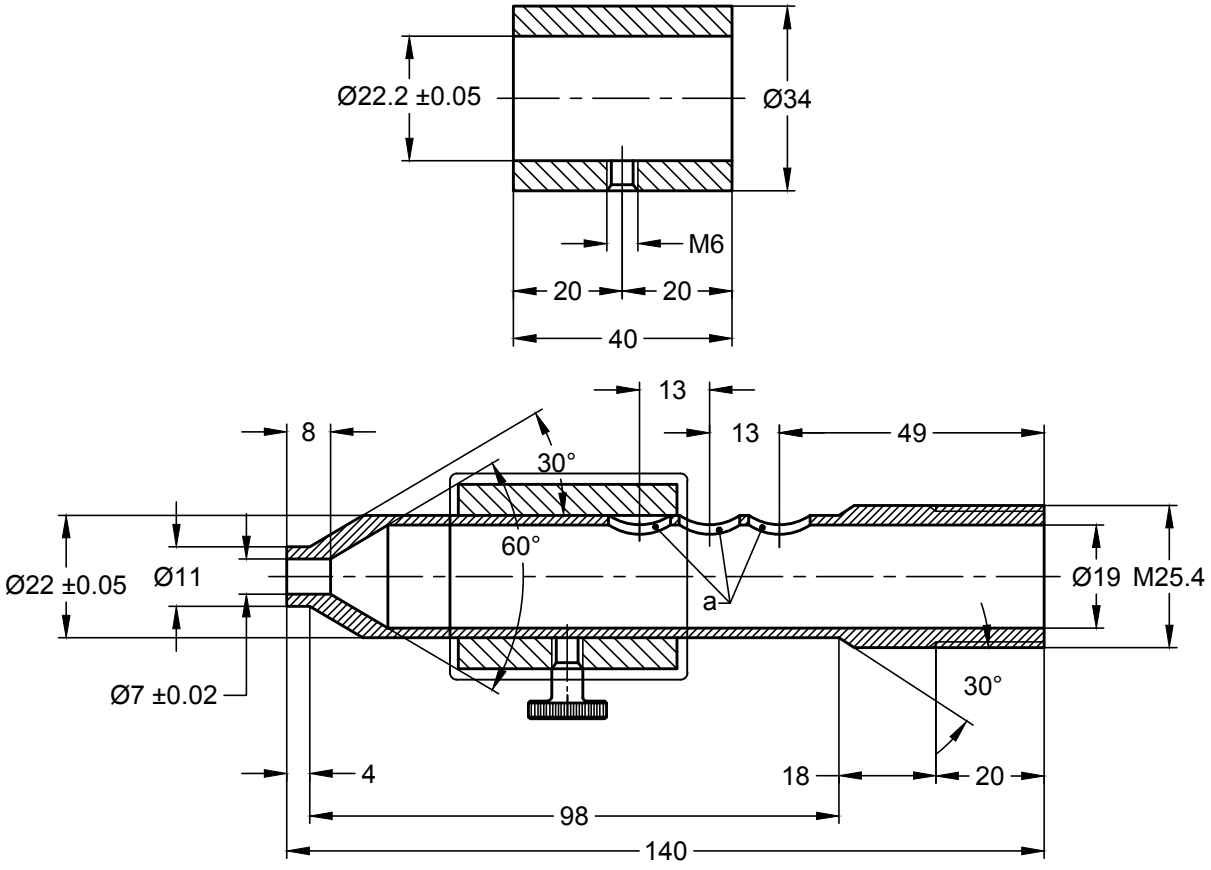
FIG. 2 SMALL SCALE FIRE TEST — FOAM COMPATIBILITY



KEY

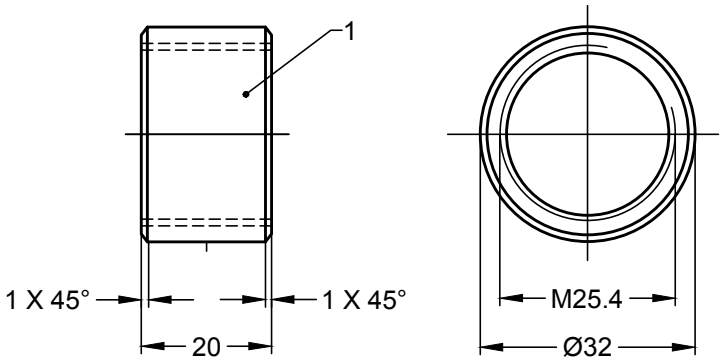
1 NOZZLE WITH FOAM DIVERTER AND SLEEVE (SEE FIG. 3B)
2 COUPLING (SEE FIG. 3C)
3 MIXING TUBE (SEE FIG. 3D)
4 STABILIZING TUBE (SEE FIG. 3E)
5 VENTURI (SEE FIG. 3F)
6 ORIFICE PLATE G (SEE FIG 3G)
7 SPACING PIECE (SEE FIG. 3H)
8 ORIFICE PLATE P (SEE FIG. 3I)
9 INLET (SEE FIG. 3L)

3A Foam Making Nozzle for Small Scale Fire Test (Foam Compatibility)



All dimensions in millimetres.

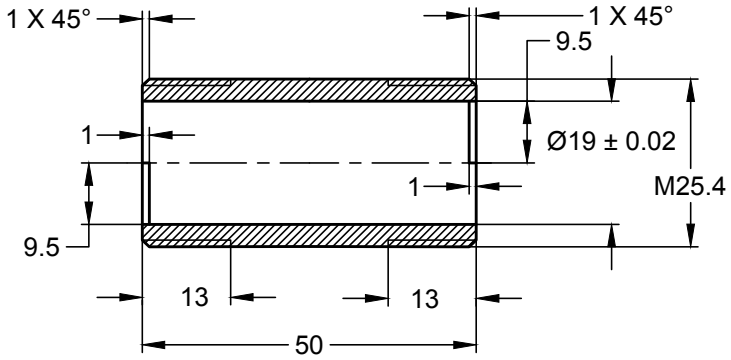
3B Item 1 — Nozzle with Foam Diverter and Sleeve



KEY
1 COARSE KNURLED

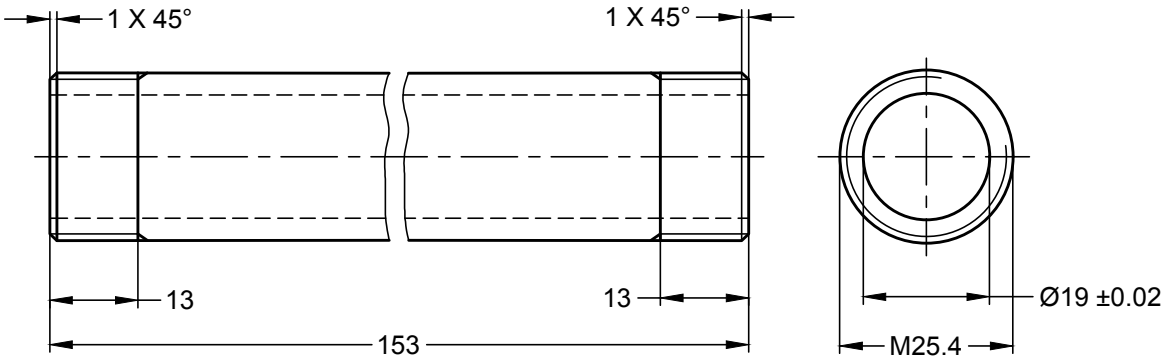
All dimensions in millimetres.

3C ITEM 2 — COUPLING



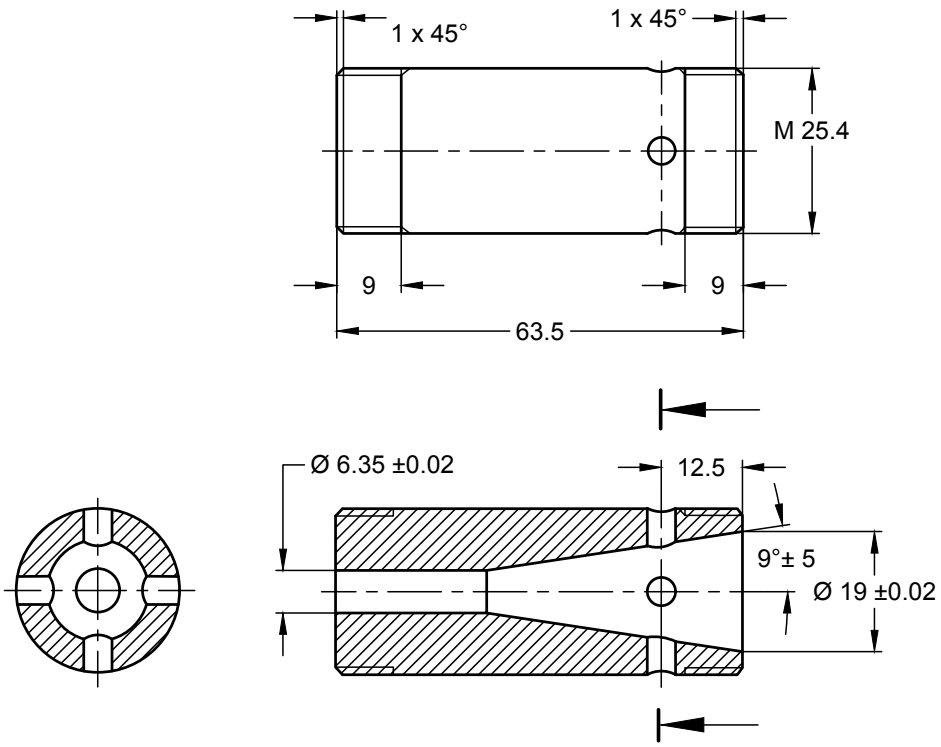
All dimensions in millimetres.

3D ITEM 3 — MIXING TUBE



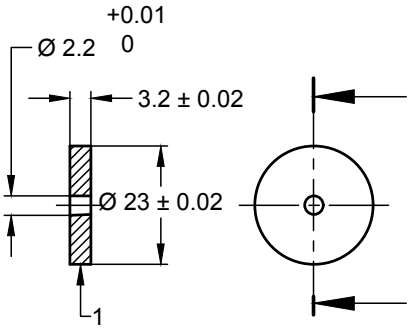
All dimensions in millimetres.

3E ITEM 4 — STABILIZING TUBE



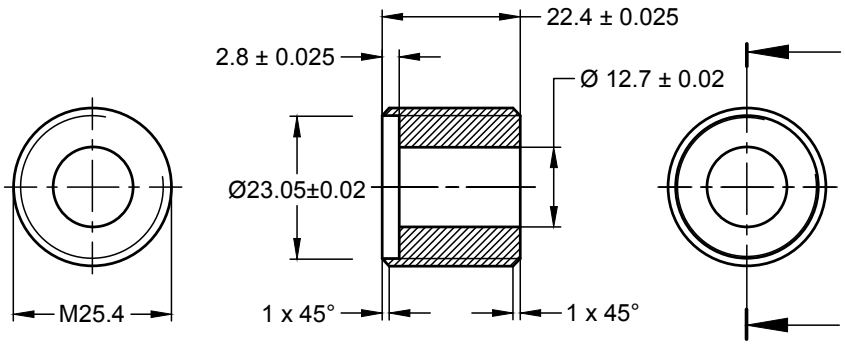
All dimensions in millimetres.

3F ITEM 5 − VENTURI



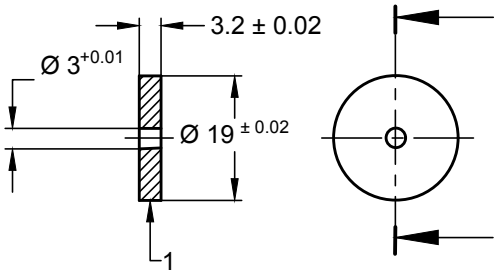
All dimensions in millimetres.

3G ITEM 6 — ORIFICE PLATE G



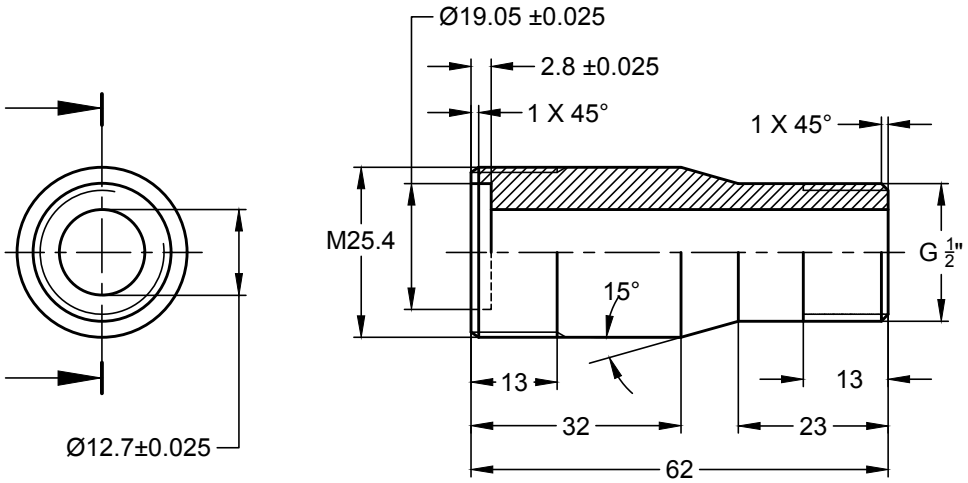
All dimensions in millimetres.

3H ITEM 7 — SPACING PIECE



All dimensions in millimetres.

3I ITEM 8 — ORIFICE PLATE P



All dimensions in millimetres.

3J ITEM 9 — INLET

FIG. 3 FOAM MAKING NOZZLE FOR SMALL SCALE FIRE TEST (FOAM COMPATIBILITY)

ANNEX J

(*Table* 1)

FIRE TEST

J-1 FIRE TEST FOR BC TYPE POWDER

4 kg BC powder shall extinguish a fire of 55B, when tested in accordance with IS 15683.

J-2 FIRE TEST FOR ABC TYPE POWDER

4 kg ABC powder shall extinguish a fire of 2A and 55B, when tested in accordance with IS 15683. No re-ignition shall occur after extinguishment of fire with in 3 min, for class A fire.

NOTE — There are no fire test requirements for the performance of dry chemical powders against Class C fires. Suitability for use against Class C may be claimed for Class B or Class AB powder only.

J-3 FIRE TEST FOR D TYPE POWDER

A square metal tray shall be used for the test. The tray shall have a base of 1 m × 1 m. Three of its vertical sides shall be each 55 mm high and the fourth side shall be 40 mm high. The tray shall be constructed with mild steel plates having a thickness of not less than 6 mm. Its upper edges shall be reinforced by suitable angle iron. The reinforcing angle shall be continuous along three equal sides of the tray to produce a turned out flush edge with the top of the tray. The top edge so formed shall be not less than 45 mm in width. The tray shall be placed on a metal stand so that its bottom is not less than 450 mm from the ground. A 25 mm thick layer of dry sand shall be spread uniformly inside the tray so as to cover its bottom completely. Turnings or chips of 500 g magnesium shall be spread over uniformly on 0.10 m² area in the tray and set alight. When the whole area covered by metal chips turnings is well alight, 9 kg of dry powder shall be applied gently through scoop/applicator within a period of 60 s by 9 kg dry powder fire extinguisher (cartridge/store pressure type) conforming to IS 15683. The fire should be completely extinguished. Leave it for 30 min undisturbed and remove the upper crust. Fire shall be completely extinguished.

ANNEX K

(*Table* 1)

TEMPERATURE RESISTANCE TEST

K-1 Pour 1 kg dry chemical powder in 1 kg fire extinguisher (cartridge/store pressure and squeeze grip type) conforming to IS 15683 and weigh accurately (W_1).

K-2 Condition this filled extinguisher as follows:

a) 55 ± 5°C for 24 h;
b) 27 ± 5°C for 2 h; and
c) (-) 10 ± 5°C for 24 h.

K-3 Within 5 min of completion of conditioning, discharge the powder completely and weigh the extinguisher accurately (W_2). Now open the mouth of the extinguisher and take out the residue powder from the extinguisher. Take the empty weight of the extinguisher accurately (W_3). Calculate the percentage of the retention of the powder as follows:

$$\text{Retention, } percent = \frac{W_1 - W_2}{W_1 - W_3} \times 100$$

ANNEX M

(*Foreword*)

COMMITTEE COMPOSITION

Fire Fighting Sectional Committee, CED 22

Organization	*Representative(s)*
Ministry of Home Affairs, New Delhi	Shri D. K. Shami (***Chairman***)
Agni Controls, Chennai	Shri D. Balachandran
Airport Authority of India, New Delhi	Shri Subhash Kumar Shri P. K. Deshmukh (*Alternate*)
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CSIR-Central Building Research Institute, Roorkee	Dr R. S. Chimote Shri Suvir Singh (*Alternate*)
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Chhatariya Rubber & Chemicals Industries, Mumbai	Shri S. A. Haveliwala Shri H. S. Haveliwala (*Alternate*)
Controllerate of Quality Assurance, Pune	Col V. V. Kadam Col N. K. N. Rao (*Alternate*)
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F. M. Engineering International India Branch, Bengaluru	Shri Sumit Khanna Shri Prasad Kulkarni (*Alternate*)
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Indian Oil Corporation Limited, Noida	Shri Aashish R. Gokhale
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K. V. Fire Chemicals (India) Pvt Ltd, Navi Mumbai	Shri Rajesh H. Sabadra Shri Uday K. Shroff (*Alternate*)

Organization	*Representative(s)*
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Reliance Industries Limited, Mumbai	Shri Varadendra Koti Shri Umesh Khandalkar (*Alternate*)
RESQ Technologies, Ahmedabad	Shri Rohit V. Shah
Safex Fire Services Limited, Mumbai	Shri Jitendra Shah Shri Sandip Shah (*Alternate*)
Shah Bhogilal Jethalal & Bros, Ahmedabad	Shri Mukesh M. Shah Shri Abhay D. Purandare (*Alternate*)
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Swastik Synergy Engineering Pvt Ltd, Mumbai	Shri Mukesh D. Shah Shri Kunal Zatakia (*Alternate*)
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West Bengal Fire and Emergency Service, Kolkata	Shri D. P. Biswas Shri G. K. Bhattacharya (*Alternate*)
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In personal capacity (K-*33-A, Green Park, New Delhi*)	Shri S. K. Dheri
In personal capacity (*A-45, Sector-70, Noida*)	Dr H. S. Kaprwan
In personal capacity (*A-347, Defence Colony, New Delhi*)	Shri R. C. Sharma
In personal capacity (*SJR Verity, VIVA-305, Amrita College Road, Bengaluru*)	Shri T. R. A. Krishnan
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Shri Srikanth Yajjala
Scientist 'C' (Civil Engineering), BIS

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Ceasefire Industries Limited, New Delhi	Shri Ashutosh Mangal
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Chennai Petroleum Corporation Limited, Chennai	Shri J. P. K. Hepat
Chhatriya Rubbers Chemicals Industries, Mumbai	Shri S. A. Haveliwala Shri H. S. Haveliwala (*Alternate*)
Controllerate of Quality Assurance, Pune	Col V. V. Kadam Col N. K. N Rao (*Alternate*)
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Devraj Engineers, Ahmedabad	Shri Vaishnav B. Shah Shri Devan B. Shah (*Alternate*)
Fire & Emergency Services, Goa	Shri Ashok Menon
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Gunnebo India Pvt Limited, Chennai	Shri K. Arul Prakash Shri Rajesh Sharma (*Alternate*)
H. D. Fire protect Pvt Limited, Thane	Shri Harish N. Dharamshi Shri K. T. Chaudhari (*Alternate*)
Institution of Fire Engineers (India), New Delhi	President General Secretary (*Alternate*)
K. V. Fire Chemicals (India) Pvt Ltd, Navi Mumbai	Shri Rajesh H. Sabadra Shri Uday K. Shroff (*Alternate*)
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Ministry of Home Affairs, New Delhi	Shri D. K. Shami Deputy Fire Adviser (*Alternate*)
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Safex Fire Services Limited, Mumbai	Shri Jitendra Shah Shri Sandip Shah (*Alternate*)
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Surex Production and Sales Private Limited, Kolkata	Shri Debashis Neogi
Topaz Fire Systems Pvt Ltd, Bengaluru	Shri Liaqut Ali Khan

Organization	*Representative(s)*
In personal capacity (K-*33-A, Green Park, New Delhi*)	SHRI S. K. DHERI
In personal capacity (*A-347, Defence Colony,New Delhi*)	SHRI R. C. SHARMA
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